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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E.C. 3, England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Increasing numbers of inquiries are being received from various parts of the tropics which can be answered only by persons possessed of an intimate knowledge of local conditions. Enquirers should first satisfy themselves that their local Department of Agriculture is not able to supply them with the desired information before communicating with us. Correspondence which will be replied to is invited on all other matters pertaining to tropical agriculture, science and development.

CO-OPERATIVE CREDIT.

IT is generally recognised as inevitable, and even desirable, that the future prosperity of many of our tropical possessions must be founded mainly, or solely, on the efforts of small peasant proprietors. The consequences attendant upon a widespread system of peasant cultivation are not, however, as well recognised as they ought to be. Since these tropical countries are becoming increasingly dependent upon the export of commercial agricultural produce and these crops are frequently exotic, the Government is forced to make provision for the spread of scientific knowledge, transport, marketing, and other facilities, and the past generation has witnessed a rapid growth of such assistance. Throughout the tropics Government is becoming more and more paternal. One further essential factor, however, still requires consideration. The peasant cultivator may have been taught to realise the value of new methods, the importance of manures, the labour saving effect of new implements, the advantages of using selected and improved planting material, and all the other factors which go to make up modern scientific agriculture, but it is futile to expect him to change his practice unless he can obtain the means wherewith to do so at reasonable terms. He may in fact possess all the essential qualifications for success except that of capital. But the peasant is out of reach of the ordinary sources of commercial credit; frequently he lives and works at a considerable distance from a Bank, his needs are so small and his resources so nebulous that the Bank finds it impossible to enter into business relations with him. Usually his main assets consist of his own industry and integrity; his land is of little value without his presence and the cost of investigating his *bona fides* so costly that loans could only be advanced on prohibitive terms. He is, therefore, thrown back upon that essential individual of village life, the money-lender or storekeeper, who, operating within a small radius, is in a position to gauge with a fair degree of accuracy the character of the applicant for a loan. Heavy losses are, however, frequent and inevitable, and the rate of interest in consequence legitimately high, so high in fact that it offers the borrower little opportunity of freeing himself from debt. Rates of interest amounting to 50 per cent. per annum may be regarded as a fairly reasonable minimum and the general condition of the peasantry may be described as one of chronic indebtedness. We

have, then, a condition in which the peasant cultivator is in urgent need of credit on reasonable terms but is not in a position to obtain it.

The European peasant experienced similar difficulties and the solution was found in the formation of Co-operative Credit Societies. Raiffeisen, Schulze, Luzzatti, and others, working along different lines, and under different conditions, but with the same ultimate objective in view, provided the European peasant agriculturist and artisan with the means of emancipating themselves from the clutches of usury. But there exist several fundamental differences between conditions in the tropics and in Europe. The European peasant is, in general, sophisticated and industrious, traits which, unfortunately, are not highly developed among the tropical peasantry. The peasant in the tropics has lived under a social system and in an environment, which has made for ignorance, suspicion and inertia. In Europe the expression of a need for reasonable credit facilities came from the peasants themselves and, once the technique of co-operation had been thoroughly explained and demonstrated to them, they were able to organise and manage their Credit Societies with a minimum of external interference. In the tropics the need for, and benefit of, Co-operative Credit Societies must be stimulated and explained by some higher authority. The peasants themselves are incapable of managing their own Societies and the officials who manage their affairs must be drawn from a class to whom the facilities offered by the Societies make no appeal. The working capital of the Societies, which in Europe has been obtained mainly from the members themselves and the usual commercial sources, must, in the tropics be obtained in the main from the Government. We have now the curious difference that in the tropics the Government must act as the proselytising, organising, financing, and controlling agency, whereas in Europe the original Societies suceeded in spite, and not because, of Governmental interference.

The consequences of these facts have, apparently, been realised in few areas outside India. The officials who are made responsible for the working of the Societies are frequently not only disinterested but also uninterested. For some unknown reason it has been tacitly assumed that anyone, even though he be devoid of any knowledge of the technique of Co-operation, can successfully organise and manage a Co-operative Credit Society. It has further been assumed that the Raiffeisen system, so effective in emancipating the European peasant agriculturist, must invariably succeed under a wide diversity of conditions. It is true that modifications have been introduced into the system "to suit local conditions," but these modifications have, frequently, resulted in the elimination of some essential factor of success. The fiction that unlimited liability is synonymous with unlimited assets has been completely and painfully exposed. The annual reports of the Co-operative Credit Societies which are received at this Institution from various parts of the Empire, with a few refreshing exceptions, make depressing reading. The balance sheets of the Societies are choked with fictitious assets and real liabilities. The ultimate losses of the Governments and other institutions immediately interested must be considerable but these monetary losses are insignificant in comparison with the loss of confidence occasioned by the failure of the Societies. In at least one area the failure is so patent that it has been publicly admitted and the Societies continue to exist merely for the purpose of recovering long overdue loans. The difficulties of subsequently introducing a sound system into this area will be insuperable; the failure is definite and final. In other areas, where the situation is not so desperate, little, apparently, is being done to nurse the Societies back into a state of efficiency. With the passage of time the inherent difficulties of the problem must inevitably be aggravated unless stringent remedial measures are immediately taken. The time for a thorough investigation into the existing systems together with the manner in which they are functioning is long, perhaps too long, overdue. Such an investigation by competently trained officers would probably reveal some of the causes for the lack of success experienced and possibly lead to the adoption of measures likely to ensure smooth working in the future. The alternative appears to be the eventual dissolution of many of the existing Societies coupled with the impossibility of subsequently introducing schemes with at least a possibility of success. The prospect is gloomy, gloomy mainly because it is not adequately appreciated.

IMPERIAL FRUIT SHOW.

THE Rt. Hon. Walter Guiness, the Minister of Agriculture, in opening the sixth Imperial Show at Holland Park, on 29th October, said that from the point of view of Empire Trade, the British fruit market offered business openings in which almost all could share. The Dominions long ago built up a great fruit export business, the West Indies had a very big trade, and recently the Straits Settlements and Malaya had produced £1,000,000 worth of tinned and bottled produce for the Empire.

The most attractive display in the Show was a "gallery" arranged by the Empire Marketing Board. There was a stand laden with apples from Canada, another with an assortment of dried fruit from Australia, a third with oranges and grape fruit from South Africa, a fourth with the citrus products of the West Indies, and a fifth with pine-apples and bananas from the Gold Coast. Numerous other fruits were temptingly displayed, and one section which suggested that the British canned fruit trade is sufficiently hardy to make it unnecessary for the public any longer to spend £9,000,000 a year under this head outside the Empire.

THE LIVERPOOL COTTON ASSOCIATION.

BY A. C. NICKSON,

Secretary, Liverpool Cotton Association.

IN writing an article on the work done by the Liverpool Cotton Association, one must naturally mention its foundation.

In Liverpool an Association was formed in 1841 of all the firms that were conducting a business in selling cotton, under the style of the "Cotton Brokers Association." Most of the business done by these firms was selling cotton consigned to them by shippers, on which business they charge a brokerage. Gradually, however, a number of firms outside this Association commenced business as merchants, buying and selling cotton for their own account, and for a short period two Associations existed in Liverpool—the Brokers and the Merchants. Finally, in 1882, an amalgamation was agreed upon, and the present Liverpool Cotton Association was formed.

The Association at the present time consists of 561 members, who comprise about 300 cotton firms conducting every class of cotton business.

The principal business is, of course, the sale of cotton on spot terms, as Liverpool has always been known as, and still is, the greatest Spot Cotton Market in the World. A large stock of every growth of cotton is held by members in warehouse in Liverpool; the largest stock ever held at a time was in 1914, when there were 1,462,112 bales of cotton in Liverpool. Out of this stock the spinners of Lancashire can fulfil their requirements.

A number of members act as buying brokers for spinners; thus, when a spinner requires cotton, he notifies his broker, who obtains samples from merchants holding a stock of cotton, and is then in a position to place a selection before the mill manager when he comes to Liverpool. Competition to sell the large Liverpool stock is keen, and the spinner is thus enabled to buy his cotton at the lowest possible price. After a purchase is made the buying broker takes charge of the transaction and acts in the spinners interest, passing the cotton for quality, arranging the forwarding and checking the invoices.

For his services the broker charges a minimum commission of $\frac{1}{2}$ per cent. on the value of the transaction, and there is no doubt that the work which is done by a buying broker is essential.

In purchases on spot terms, the price of the cotton is sometimes actually fixed at the time the contract is made, and at other times the cotton is sold "on call" on a certain month—that is, it is agreed in the contract that the price shall be fixed at a certain number of points "on" or "off" a given month for future delivery, the date of the fixing being usually at the option of the buyer. In this way a spinner secures a certain quality of cotton on the basis of futures, and has the privilege of fixing the price at any time convenient to himself.

As regards claims for quality, these must be made before delivery is actually taken, and it is one of the duties of the buying broker to see that the cotton is correct before delivery. After that time the only claim that can be made is for false-packed or unmerchantable cotton, which cannot be discovered until the bale is actually opened at the mill.

The Association provides forms of contracts by which cotton can be sold on spot terms for delivery at a future date. The rules governing these contracts are on the same basis as those governing spot cotton, but at the time the transaction is made the cotton need not be in Liverpool, the terms of the sale being that the cotton must be of a certain description as compared with the official standards, or equal to an actual "type" of cotton which is kept by the buyer. When the cotton arrives, the out-turn samples are compared with the standard representing the description of cotton bought, or with type, as the case may be, and should any difference arise as regards the quality of the cotton, the matter is decided by arbitration. In the same way as spot cotton, the price may be either fixed at the time the contract is made, or "on call."

An important provision in this contract is that bales tendered which are not equal to the selling sample, or the description of the cotton contracted for, may be exchanged once, or a second tender may be made within the period allowed for delivery under the contract.

Payment is by cash in ten days, or before delivery is required.

The majority of the business in cotton in spot terms sold to the Lancashire spinner is transacted in this form of contract.

Shippers usually have their own representatives in Liverpool, who are posted by cable as regards cotton offered for shipment, and these agents enter into contracts on behalf of their principals abroad. This system is of recent development, as, before the war, Liverpool merchants usually had their own houses in America, staffed by young Englishmen who bought the cotton from the factory, or farmer, in America. American Immigration Laws, however, have made this practice more and more difficult until, at the present time, very few merchants have their own houses in the States.

The Liverpool merchant is taking an increasing interest in cotton in different Colonies in Africa, and branch offices are gradually being opened in that part of the world.

The Egyptian and Sudan business is also conducted on C.I.F. terms by the Liverpool merchants, who are in close communication with cotton export firms in Alexandria. A number of the large Liverpool houses have branches in Egypt.

Liverpool, New York, and New Orleans are the three important "Futures" markets for trading in American cotton. There are "Futures" markets in Bombay for East Indian cotton, and Alexandria for Egyptian cotton, but Liverpool

is unique in that it has "Futures" contracts for American, for Egyptian, and also for Empire and miscellaneous growths. In the last contract, every growth of cotton, with the exception of certain grades of Egyptian and Sudan, is tenderable provided, of course, that the quality tendered is within the terms of the contract.

A number of interesting booklets have been written on the subject of cotton futures, and space will hardly permit of a detailed account of the various forms of trading.

The minimum contract in American cotton is 100 bales, in Egyptian and Empire, 50 bales. The seller in his contract undertakes to deliver to the buyer in a given month a certain weight of cotton, which the buyer on his part must accept, provided the cotton tendered is within certain grades and staple, which are defined in the contract. The basis of the contract is actual cotton, and unless the contract is closed before maturity, actual cotton must be delivered and accepted.

The market is used by almost every section of the cotton trade both at home and abroad for "hedging" purposes, which means that those engaged in the trade can protect themselves from sudden and large fluctuations which take place in the value of cotton. Importers buying cotton for shipment in a certain month which they have not resold, hedge themselves by the sale of futures, and are thus protected against a decline in values before the actual cotton is sold.

In the same way spinners who have not sold their product can protect themselves by a sale in the futures market, and when their yarn is sold they repurchase their hedge, which has acted as a protection during the intervening period.

Orders for the Liverpool futures market are received by Liverpool brokers from all parts of the world, and it is this fact which makes the market one in which a purchase or sale can always be made at the ruling price, large buying or selling orders being transacted without any unreasonable fluctuations taking place.

The contract calls for weekly payment of differences, and these are settled through the medium of the Association Clearing House each Thursday.

The charge made by the broker for transacting an order for futures for account of a non-member client is a minimum of $\frac{1}{8}$ per cent. The Association, however, allows a reduction of this brokerage to a minimum of $\frac{1}{4}$ per cent. to clients who are elected as Associate Members. These are persons in this country who are closely connected with the cotton trade, viz., spinners, importers, yarn agents, &c. The privilege is also extended to persons abroad provided they are members of recognised Cotton Exchanges, such as New York, New Orleans, Havre, Bremen, Bombay, Alexandria, &c., and rules have recently been passed that British subjects resident within the British Empire who are engaged in shipping cotton to this country are also eligible, provided they are members of a Cotton Exchange. It is hoped that this regulation will encourage the formation of Cotton Exchanges throughout the Empire where cotton is being grown, and the Association is prepared to give all the advice and help it can to those who undertake the work of establishing these Exchanges.

The Association for many years had established Liverpool standards for various growths of cotton; until 1923 these were the standards upon which all European transactions were based. In 1923, however, universal standards for American cotton were agreed upon between the European Exchanges and the Department of Agriculture at Washington, and these have been adopted by the Liverpool Association. The Liverpool standards for all other growths still remain, and are added to as the various new growths for cotton become more important.

All contracts that are made subject to the Articles and Rules of the Association provide that differences or disputes must be settled by arbitration.

The procedure is that each party to the contract appoints a member of the Association to act as Arbitrator, representing his interests, and fully posts him with his view of the case; should the Arbitrators be unable to agree, another member is called in to act as umpire, and his award is communicated to the contracting parties. Either party has, within a stated time, a right of appeal against the award, in the case of quality to the Appeal Committee, or in any other case to the Directors.

Should either party to the contract refuse or neglect to appoint an arbitrator after application to do so has been made to him by the other party to the contract, application may be made to the President of the Association, and if he sees fit he is empowered, under the Rules, to appoint an arbitrator to act for the defaulting party.

There are a number of Appeal Committees, elected each year, for various growths of cotton, and the members of these Committees are experts in the particular growth represented by these Committees. It is difficult to give any figures showing the number of arbitrations on quality which are held in a year, but it would be no exaggeration to state that at least 570,000 bales are adjudicated upon in the Association official arbitration rooms each year.

The Rules provide a further safeguard in the case of quality—that if a contracting party feels that a manifest error has been made by an Appeal Committee in valuing cotton, there is a right of super-appeal to the Directors. The appellant states his case before the Board, and if it is considered that a *prima facie* case has been made out, the Directors appoint a Special Committee to reconsider the case.

The Board then issue their award, which is final and must be conformed to by both parties to the contract.

Another important provision with regard to the Liverpool contracts is that they contain a clause to the effect that the contract cannot be cancelled on any ground, and therefore, if it is decided by arbitration that the contract is to be closed, this is done by the buyer invoicing the contract back to the seller at the value in Liverpool on the date of arbitration or appeal, as fixed by arbitration; thus the buyer and seller are placed in the position of being able to replace their contracts.

The Association is governed by the President, Vice-President, and body of Directors. The President and Vice-President are appointed each year by the members, the Directors also being appointed by the members, retiring by rotation every three years. The numerous Committees are elected each year—namely, Appeal Committees and Committees for fixing the quotations, and the ordinary Committees required to carry on the affairs of the Association, such as the Finance Committee, Committee for making Rules, &c.

The Directors have very stringent powers over the members in the cases of insolvency or misconduct, these being provided for in the Articles of the Association.

All alterations to the Articles and Rules have to be passed, in accordance with the Companies Act, by the members in General Meeting.

The Cotton Exchange building itself, contains the Exchange, where trading in the various futures contracts takes place, and in the building are also innumerable offices for members of the Association. The official Arbitration and Appeal Rooms are also in the building, situated where the best light for judging cotton can be obtained. —*Empire Cotton Growing Review*, Vol. III. No. 4.

PAWPAW.

THE pawpaw is a fast growing tree. It bears in 10 to 12 months, and produces fruit all the year round until about 5 or 6 years of age, after which it starts deteriorating and dying off.

It is a delicious fruit and a favourite for dessert, and aids digestion. The tree usually attains a height of 15 to 20 feet; and the fruits vary in size and shape.

The milk obtained by tapping the unripe fruit is called "Papain," and is a valuable commercial product which is exported to Europe for medicinal purposes.

The best soil for the cultivation of the pawpaw is a rich porous soil. The land should be in a sheltered situation, as the pawpaw tree will not stand strong winds.

Seeds should be sown in nursery beds, and the seedlings transplanted when they are about 3 inches high.

Fresh seeds are more suitable than dry seeds, as the former will germinate more readily in about a fortnight; whereas the latter take a month or two.

In transplanting the seedlings in the field they should be planted at a distance of 12 to 15 feet each way. Very close planting is liable to develop disease.—(*Jour. Gold Coast Agric. and Commercial Society.*)

MANURING OF SUGAR-CANE.

WE have recently received a pamphlet on this subject compiled by Dr. A. Jacob and Mr. V. Coyle. It describes chiefly the results obtained at the Clatten Experiment Station in Java. Nevertheless the main conclusions are worthy of note by sugar-cane planters.

The authors first state that a crop of 42 tons of sugar-cane per acre (variety not given) removes 76 lb. of Nitrogen, 53 lb. of Phosphate, 72 lb. of Lime and 173 lb. of Potash from the soil. Whilst excessive manuring with nitrogenous fertilizers leads to luxuriant growth, the sugar content of the cane is thereby lowered, and the mechanical strength of the cane is diminished. Potash counteracts these tendencies, and should, therefore always be supplied when high nitrogenous manuring is practised. Phosphate hastens ripening, and should not be omitted from a balanced fertilizer for sugar-cane.

These conclusions are supported by certain Cuban experiments which are next described. In Cuba, manurial mixtures containing a high proportion of Potash proved to be the best. The same experience was gained at the Bundaberg Sugar-cane Experiment Station in Queensland, Australia.

Finally, the authors suggest the following complete fertilizer for the sugar-cane crop.

1. Sulphate of Ammonia	250-500 lb.	per acre.
or Nitrate of Soda	300-600 lb.	
2. Superphosphate of Lime	300-600 lb.	
or Basic Slag	300-600 lb.	
or Bone meal	200-400 lb.	
3. Sulphate of Potash	100-200 lb.	

It should be pointed out, however, that this general recommendation probably applies only to sugar-cane growing on poor soil possessing suitable tilth, for it is well known that different results are obtained when different soils are treated with the same manurial mixture in different parts of the world. The main point brought out by the pamphlet is that potash fertilizers should not be left out of account when manurial programmes for sugar-cane cultivation are under consideration, nor should attention be centred entirely on nitrogenous fertilizers, as is unfortunately the common custom.

F. HARDY.

ADVERTISEMENTS.

MR. HENRY H. R. MOLE, of Little Neck, Long Island, New York, has been appointed advertising agent for *Tropical Agriculture* in the United States of America and Canada. All communications from those countries respecting advertisements should be addressed to him. The address of our advertising agent in the United Kingdom is 14, Trinity Square, London, E.C.3. Firms in the West Indies and British Guiana are requested to address their communications to the Editor, *Tropical Agriculture*, Imperial College of Tropical Agriculture, Trinidad.

CROPS SUBSIDIARY TO CANE.

PROFESSOR J. SYDNEY DASH, B.S.A.

RISKS from monocultural cropping have been constantly emphasized in this Journal. There is no need, it is felt, to elaborate on these risks which are now fairly well known. It is admitted that the economic conditions under which tropical agriculture is carried on have in a large measure tended to focus the attention on a one-crop system and in this connection sugar-cane agriculture is an important example among tropical arable crops. Only Java, with a state-controlled system of land tenure, among the large sugar producing countries, can point to any well-ordered system of crop rotation, and this has been brought about as a result of the dependence of the large population on locally grown foods which can be easily and economically grown. Notwithstanding, the suggestion has been made that it would be more profitable for Java to increase her sugar output and import, if necessary, foods such as rice which, compared with sugar, is a poor producing crop unit. In the present unsettled outlook, and with a view to giving cane agriculture greater stability than it has enjoyed in the past, the time has arrived when serious consideration should be given to future policies of field management and especially those relating to the use of other crops in cane areas. In Trinidad the necessity for this is becoming more and more imperative as a result of persistent froghopper attacks; these lands, in the past have scarcely grown any crop other than cane, their peculiar low and heavy nature rendering them difficult to handle, and not well adapted to crops requiring optimum tilth, especially in the early stages of growth. Thus the problem of finding a suitable cash crop subsidiary to cane in these areas is not easy of solution. Some change in field policy is particularly urgent, however, since the froghopper is essentially a grass-loving insect and finds conditions easy for its existence where thrown-out cane lands are abandoned to grass and the traces between fields largely used as sources of a permanent fodder supply out of the grinding season.

Without unnecessary descriptive detail—suggestions rather than hard and fast ideas being the aim—it is proposed to call attention to the utility or otherwise, in this connection, of certain crops under observation in the College Department of Agriculture. They may be considered under three heads:—(1) Cover and forage crops; (2) Provision crops; (3) Special crops.

Cover and Forage Crops.

It may be said at the outset that it is in this category of crops that the greatest immediate hope appears to lie, both on account of their easy adaptability to the conditions under notice and because the utilization of such crops offers the least disruptive change. In other words, no revolution in cane agriculture if such were possible—is contemplated by urging their incorporation in the present system. Broadly speaking, their adoption would enable full use to be made of thrown-out cane lands which, besides, would benefit very materially from (1) increased fertility (2) improved tilth (3) weed and grass suppression—a decidedly important factor in the present circumstances. It is true that cover and forage crops may not necessarily possess a value easily assessed in terms of ready cash; nevertheless, in many cases the value of their products as stock food can be set off against purchases of feeding stuffs which usually amount to a considerable sum on most sugar plantations. Planters, therefore, should not be unduly apprehensive in respect to any additional cost in the growing of these crops when all the indirect benefits are taken into consideration and when, moreover, they might be made, by judicious handling to yield a steady and valuable supply of forage and concentrates. There may be times in the year, undoubtedly, when local stock foods may be bought cheaper than they can be grown, but it is not unlikely that introduced into a regular cropping system differences in favour of purchasing outside would tend to be evened up and a regular supply also ensured.

Reference to the use of cover crops in soil management have been made from time to time by the writer in the pages of this Journal. In this connection attention might with advantage be directed to *Tropical Agriculture* Vol. I, pp. 53-54 and Vol. II, p. 37.

For general purposes, useful both on abandoned agricultural land and on old cane lands there is nothing, in the writer's opinion to equal Bengal Bean—a black-seeded Stizolobium (*S. aterrimum*)—under Trinidad conditions. It has been found to smother grass very efficiently, besides producing a very excellent tilth on newly-broken grass land. Unlike its close relative the Velvet Bean, it may be depended on to maintain heavy growth throughout the rainy season—6 months—and therein lies its special value on thrown-out cane fields. In addition, the plant makes excellent forage for all classes of animals and if allowed to produce a seed crop this can be milled and mixed with poorer substances such as maize. It may be noted that the shelled seeds contain over 20 per cent. of nitrogenous matter and nearly 3 per cent. of fat. Grown for seed at the College and planted in October in unmanured land a yield of 2,000 lb. to the acre has been obtained. Allowing 50 lb. of seed to plant an acre when broadcast and half the quantity if drilled in, one acre of Bengal Beans will easily produce enough seed to plant at least 40 acres and double the area where drilled. It is likely that this yield would be exceeded where supports are given to the plants, and the cost of putting in special supports would have to be taken into consideration. Planted late in the rainy season, the seed matures in the dry season and the pods do not rot to the same extent as when early planted. The suggestion is that they might be planted

between the cane rows after reaping the last ratoons where cover and green fodder are the objects aimed at, and say in September or October for seed purposes. In the former case, cane sprouts mixed in with the green vines form a well-balanced forage. Where not required for forage, although the greatest profit will probably result from such usage—the vines as roughage, the beans as concentrates—the crop may be ploughed under and returned direct to the soil. In the case of permanent crops the bean might be used to great advantage in coconut cultivation, but will have to be kept cut back when used in citrus or cocoa orchards ; in the latter case Sword Bean (*Canavalia*) would be better. This plan also makes an efficient cover but does not seem to be relished by livestock. In the same order of ideas attention may be directed to Pigeon Pea (*Cajanus indicus*) although it is not so well suited to rough lands as either of the former. It makes excellent forage, and the seeds may be utilised as food both for man and beast. Several other types of plants for cover and forage purposes are under observation at the present time, a promising one being Sunn Hemp. (*Crotalaria juncea.*) It is a very fast grower and being of erect habit should be useful where a non-climbing type is wanted ; it is essentially a short season cover. Where kept for seed it may be cut back in the same way as Pigeon Pea and allowed to produce two or more crops of seed. Some difficulty is being experienced with insect damage to the young pods, and experiments are in progress in order to find out exactly the best time for planting Crotalaria with a view to escaping attacks of this pest (*Utethesia ornatrix*, Linn.). Generally speaking in the early months of the rainy season hardly a sound pod can be found while late plantings have returned satisfactory seed yields.

It is sometimes recommended to plant certain cover crops on the banks between young plant canes in order to aid in the suppression of weeds, to be pulled off and buried in the furrow when the pen manure is being applied. It not infrequently happens, however, that their use in this way may retard the application of the pen manure, early application of which to plant canes must be regarded as of paramount importance. Again when left too long, they may rob the young canes of moisture, especially if allowed to remain after the dry season has set in when surface cultivation would be more beneficial to the cane crop. Some experience is necessary to get the best out of them utilised in this particular way.

An important factor in the growing of any of these crops is the management of seed supplies ; in this connection Bengal Bean and Sword Bean are less liable to insect attack in storage than Pigeon Pea and Cowpea.

Finally, a greater effort should be made on the estates to conserve cane tops for out of season feeding. These, with bean or pea meal and molasses make a satisfactory and nutritious diet which would be appreciated until fresh supplies of green fodder are ready. In any case, Uba cane grown for forage purposes should be available at this period to provide abundant succulent material.

(*To be concluded.*)

BEET SUGAR IN ENGLAND.

A BEET sugar campaign is being started in England. According to the *International Sugar Journal* (Vol. XXVIII, pp. 509 and 575), further attempts are being made to justify the erection of several factories in the south of England. The Yeovil factory has been abandoned but in Wiltshire the Anglo-Dutch group are nursing the county with a view to getting support for a factory there, possibly at Warminster. A new factory is also projected for the Wellington district of Shropshire, and a company has been formed to carry it out, subject to the promise of a minimum of 8,000 acres by the beginning of December. This project would cost upwards of a quarter of a million, and if the necessary support is forthcoming, the plans are for the factory to be erected in time for the 1927 crop.

The favourable weather of mid-September added much to the sugar content of the roots, which are everywhere reported to be much above the average ; while the frosts which put in an appearance in October do not appear to have been severe enough to do any material damage. Cantley is slicing about 1,500 tons daily. Kelham reports a very high sugar content in its roots. Spalding, which was unable to start last year owing to lack of an adequate water supply, has now got ample water, and being able to get delivery of foreign coal by water has been able to make a good start ; it is expected to deal with 65,000 tons of roots during its initial campaign. Peterborough, which has been built in the short time of eight months has started to time and is dealing with 500 to 600 tons daily, as against its designed capacity of 700 tons. Felsted has also started its first campaign, and hopes to slice in all 60,000 tons of beets. The roots within its area are expected to average 17 per cent., while some of the first lots attained 19.8 per cent. Colwich is hoping to slice 110,000 to 120,000 tons as agaist 75,000 last season. The reports of roots grown at Cupar in Fife are also very favourable.

The Anglo-Scottish group are being cautious, on the basis on experience in 1925, Lord Weir stated that his Corporation's contracts were "costly failure, redeemed only by their success in bringing in new growers." Now he advocated the development of a system that will link the growers still closer to the factory, so that they and it become real partners. He would like to see contracts based on more modest guaranteed minimum rates, such rates being on a true economic basis and then in addition a bonus on the financial results of the campaign.—(*The International Sugar Journal*, Vol. XXVIII, 334-5.)

COTTON NOTES.

Recent Work on Measurable Characters of the Cotton Hair.

CONSIDERABLE additions to our knowledge of the quantitative aspect of the cotton hair continue to be made by the staff of the Shirley Institute. Miss G. C. Clegg (*Shirley Institute Memoirs*, Vol. V, Pt. 18, 1926) in a paper entitled "The breaking of yarns and single cotton hairs" discusses the question whether cotton yarn breaks by rupture of the constituent hairs or chiefly by slip of hair on hair. By the Congo red staining method it is shown that in yarns broken on a single thread tester or a ballistic instrument a considerable proportion of the hairs are actually broken—as many as 70 per cent. in a Sakel 36's weft. In two cottons N17 and Az, the single thread breaking load indicated, is only 38 per cent. and 41 per cent. respectively of the value to be expected if each hair in the yarn cross-section is assumed to have the mean single hair breaking load as determined by the O'Neill tester. No correlation is said to be shown between yarn strength and single hair breaking load; though the co-efficient of correlation is not calculated.

In discussing the breaking load of single cotton hairs the author makes no mention of her own previous investigations (*Shirley Institute Memoirs*, Vol. II, No. 28, 1924) probably because some of the conclusions in the second paper are at variance with those in the first.

In the more recent paper she states: "It was generally found on plotting the frequency arrays that the curves were either two-peaked or decidedly skew. Increasing the number of observations did not modify the form of curve owing to the persistence in the sample of an undue proportion of weak hairs. Furthermore, the range was always extensive owing to the fact that some of the strongest hairs gave breaking loads twenty to thirty times as great as those of the weakest. Data from which such curves are constructed do not lend themselves to elementary statistical treatment, nor has the arithmetic mean more than a slight significance from a practical point of view."

In the early paper, frequency arrays are presented for breaking load of 14 cottons. Of these none of the pure lines of Sea Island are definitely bimodal, though the skew curve is characteristic. The bimodality of a breaking load curve may be due either to faulty sampling, or to the presence of two different types of hair forming two overlapping frequency curves, such as would result from the presence of imperfectly developed and dead seeds. This in itself is interesting and should be studied from a physiological point of view. If bimodality is characteristic of some cottons, monomodality is equally characteristic of others. It is equally important to recognise differences in skewness, for they may reveal defects in a system of cultivation which cannot otherwise be detected, or be indicative of particular types of environment. There is considerable evidence that the peculiarity of Punjab American are due to faulty irrigation.

In spite of the fact that the author has previously shown that the mean of approximately 100 observations on a carefully sampled cotton is not subject to a probable error of more than 3 per cent., she becomes dubious about the value of breaking load results, and considers that the single hair breaking load is indefinite. If this is the case, it seems strange that the value of the breaking load for Khanewal 285F in her first paper is 3.1 grm. (on 415 observations), and in the second paper 3.1 grm. (on 200 observations). The truth is that given careful sampling and adequate standardisation of working conditions, the mean breaking load of a sample of cotton can be determined, and in spite of variations in the proportion of abnormal or weakened hairs, it is a value which can be obtained as many times as is necessary by repetition. The author further states that abnormal or weakened hairs are not likely to occur in the same proportion in different samples of the same cotton, and consequently the breaking load is likely to be affected to an unknown extent, thus being an unreliable index to the strength of the cotton. It is, however, quite clear that proper sampling will distribute the abnormal or weakened hairs evenly throughout the sample, and consecutive samples will give—again within the probable error limit similar proportions of abnormalities. The author takes a random sample, of 202 hairs of Zaria cotton and finds 72 possessing abnormalities of structure. What would be the proportion of abnormal hairs in further samples of the same size? No doubt the proportion of abnormal hairs, provided that they are structural and not due to faulty handling, is as definite a feature of a type of cotton as any other quantitative character, and variations in the proportion of abnormal hairs need careful investigation.

The length of the test piece is discussed at some length and it is shown that with 1 millimetre lengths the breaking load rises and the data becomes less irregular. As the author says, this is because there is less chance of including the weakest point of the hair. It is suggested that whole hairs be broken instead of centimetre pieces, in order to obtain the maximum chance of encountering the weakest place in each.

The objects of breaking load determinations are briefly as follows:—

(*a*) to determine the form of the curve in different types of cotton, and variations in the statistical constants of that curve

(*b*) to use the data in correlating the measurable characters of the raw cottons with spinning properties.

If a characteristic curve can be obtained by using 1cm. pieces and if this value has been accepted as a convenient working standard, why change it?

In discussing the relation between breaking load and wall thickness the author states that "the relation between the two quantities is not very definite," and "cottons with approximately equal wall thickness may have very different breaking loads and *vice versa*." This is true, but as previous workers have pointed out cotton cannot be expected to give the same behaviour as bits of piano wire. To state, however, that "most of the disturbance of the relation is due to the irregularity and variability of the quantity determined as breaking load," is only another way of saying that the differences in the structure of the cellulose material which manifest themselves from hair to hair are more delicately revealed by a breaking load test than by measurements of wall thickness, or that a breaking load determination integrates a larger number of hair characters. In regard to the relation between wall thickness and breaking load, the author makes no reference to her previous figures for the correlation coefficient of $r = +0.6 \pm .068, +0.54 \pm .089$, and $+0.46 \pm .088$ of breaking load and mercerised diameter. To use the phrase "not very definite" when statistical methods are available for the elucidation of the degree of relationship is a retrograde step in the present state of our knowledge of cotton. In point of fact the diagram is a typical correlation surface exhibiting high positive correlation.

The point is made that the curves for wall thickness are regular and unimodal, whereas the curves for breaking load are more irregular and often bimodal. It must be borne in mind that a comparison from this point of view should be made on an equal number of class intervals, and in terms of standard deviation. If the number of classes in hair strength determination is reduced to seven, *i.e.*, if the curves be plotted to the nearest gram the curves are usually quite smooth and monomodal.

S. C. HARLAND.

RUBBER RESEARCH INSTITUTE.

WE learn that a Rubber Research Institute has recently been incorporated by enactment of the Federated Malay States legislature for the purpose of research into and investigation of all problems and matters relating to rubber. This Institute is financed from Government funds and is managed by a Board representative of Government and of the rubber growing interests. Dr. G. Bryce has been appointed Director and the staff is now being recruited and it is expected that work will be under way in 1927. During the past three years Dr. Bryce has been Director of Agriculture of the Mandated Territory of New Guinea with headquarters at Rabaul, an appointment under the Commonwealth Government of Australia. Previously he was the Assistant Mycologist in the Ceylon Agricultural Department.

It is announced that in due course the Institute will issue publications in the form of technical bulletins or a journal.

SUGAR REFINERY CLOSES DOWN.

THE largest cane sugar refinery in Great Britain—that of Messrs. Tate and Lyle, Ltd., at Plaiston Wharf, Victoria Docks, E., employing 2,600 men—has closed down temporarily. A second of the firm's factories at Silvertown, employing 2,300 men, is working half time, and may shortly have to close down. The same fate threatens to overtake their Liverpool factory, which employs 2,000 men. The chairman of directors, Sir Leonard Lyle, gives as causes, the subsidising of British beet, and the dumping in London alone of 100,000 tons of foreign sugar.

The refiners suggest that the argument of the Government—that any increase in home grown production due to the subsidy will displace sugar from the Continent and America—is defeated by the action of the foreigner, who, protected in his own market, can dump his surplus product abroad at prices lower than in their own country. For example, the producers in Czecho-Slovakia enjoy a special tariff and are selling sugar in the British Isles at 4*s.* 6*d.* per cwt. cheaper than in their own country.

In reply to a question in the House of Commons, the Minister of Agriculture said he would find it difficult to attribute the closing of refineries to the beet sugar subsidy seeing that the total of the British sugar put upon the market last year was just over 50,000 tons, the total annual consumption being estimated at 1,700,000 tons.—(*Daily Telegraph.*)

COCOA PLANTERS' ASSOCIATION.

Annual Report.

A COPY of the annual report of the Cocoa Planters' Association of Trinidad, for the year ending 30th June, 1926, has just been received. During this period cocoa realised $12.62\frac{1}{2}$ a fanega (110 lb.). The Deferred Deposit Fund was increased to $31,018.20. Cocoa handled by the Association amounted to 47,418 bags, of 165 lb. each, of which almost exactly half went to the United States of America. The registered membership increased from 171 to 187 during the year, there being 25 new members, while 3 were excluded, 2 resigned, and 4 automatically ceased to be members owing to the sale of their estates. The disappearance of 3 members by exclusion indicates that the Association is determined to maintain the high reputation which it has established in the world's cocoa markets. It is interesting to note that during the year ending 30th June, 1918, only 25,227 bags of cocoa were marketed through the Association. The rapid increase in the amount of cocoa handled has made the Association a highly important factor in the marketing of the better grades of Trinidad cocoa. A more extended review of the activities of the Association appeared in our issue of December, 1925, Vol. II, No. 12, pp. 289-291.

C. Y. S.

TROPICAL WORLD NOTES.

British Guiana.

The trade of the Colony during the year compares very unfavourably with that for 1925, both imports and exports having suffered considerably from the effects of the drought. Besides sugar, rum also shows a decrease for the period January to October as compared with the corresponding period last year. Although the acreage of sugar is 57,500 against 57,190 in 1925, the crop is expected to be 27,000 to 80,000 tons less than the total in 1925. The reduction is due to drought and very unfavourable weather experienced in the earlier part of the year.

The figures for rice exports are 4,000,000 lb. as against nearly 12,000,000 lb. but there is every promise of greatly increased production and of an early recovery in exports. This year the acreage of rice is 46,538 or 17,208 acres more than last year and the return per acre is expected to be somewhat higher than before.

Exports showing gratifying increases are copra and coffee, the former to the extent of 110,000 dollars and the latter 25,000 dollars.

One of the necessities of British Guiana is an adequate labour supply. An estimate of the scheme for the introduction of 500 families recommended by the Indian delegate, Mr. Singh, has been prepared and awaits examination by a committee appointed specially to deal with it. The preliminary estimate of the cost of the Singh scheme affords ground for serious doubt whether the scheme is within the financial capacity of the Colony. Should this doubt be confirmed on investigation by the committee, it seems that all hope of immigration on any considerable scale from within the Empire must for the present be abandoned.—(*From the speech of the Governor at the Opening of the Combined Court.*)

* * *

Kenya.

The Agricultural Census of the Colony and Protectorate reviews the position as existing on 30th June, 1925, 392,628 acres, or 8.88 per cent. of the total occupied area, were under cultivation—an increase of 13.15 per cent. over 1924 and 67.75 per cent. over 1922. The change in area devoted to particular crops is seen from the following table :

Crop.	1922.	1923.	1924.	1925.
Maize ..	32.2	36.4	40.7	39.7
Coffee ..	18.5	19.0	17.3	16.6
Sisal ..	15.9	14.2	13.1	13.4
Wheat ..	5.9	5.6	6.0	5.4
Coconuts ..	4.0	3.2	2.6	2.3
Sugar Cane ..	1.6	1.5	1.5	1.7

To quote from the Report of the Director of Agriculture—"It could hardly be expected that the rapid rates of increase of recent years could be maintained. Nevertheless there is evidence of steady and substantial progress. The tendency to concentrate effort upon the production of the staple crops, maize, coffee, sisal and wheat is evident. To less important crops little attention is devoted, and in some cases a marked decline is shown. Clearly the Agricultural Industry is getting into its stride and year by year there is less uncertainty about the form which production should take and markets and trade connections for the main products are being improved. The chief factors which operated against greater production and further increased development in 1924-25 were a rather unfavourable season and insufficient labour. Of new capital ready to be put into agricultural development there was said to be a large increase, and in addition the profits which are undoubtedly being made in farming operations go back largely into farm improvements."

* * *

Colombia.

In communication with a member of the College staff, Mr. R. Parga gives some further information regarding the progress of Colombia in which country he is now settled. A previous note was published in our issue for September last, Vol. III, No. 9. In this note it was stated that a revenue of $1,500,000 was entering the National Treasury each month. This should have read, the surplus over the estimated revenue; the actual revenue exceeded $4,000,000 a month. Mr. Parga writes that the past year has been exceedingly trying, Colombia having experienced the worst drought for a considerable number of years. There has been a great loss in cattle and now that the rain has commenced it will probably be worst, as many of the emaciated animals will not be able to resist heavy showers. In the Tolima Valley the pastures look as if a wave of locusts had passed over them. The river has been dry for a considerable time and has resulted in heavy congestion at the ports. Merchants who receive goods on which they paid heavy duties many months previously often find them deteriorated in value. The river freights have increased considerably. Fortunately the price of coffee remains high, but the poor people have been hard hit owing to the partial failure of the food crops and the prevailing high prices for other commodities. It was anticipated that the National Revenue, 60-70 per cent. of which is derived from Customs duties would decrease but on the contrary it has increased. This is attributed largely to the development of the Pacific departments which with the splendid climate, the wonderful soil, proximity to the sea, good railways and roads are developing at a tremendous rate. The Government is endeavouring to get Congress to authorise a loan for $100,000,000 for an extensive scheme of public works, chiefly railways, improving the ports and "regularising" the Magdelena. It is anticipated that Congress will pass the necessary law and in the course of four or five years the transport question will have changed completely.

West Africa.

During the past ten years great advances have been made in the design of machines for use in the palm oil industry. The chief factor responsible has been the extensive cultivation of the oil palm in the Dutch East Indies and its anticipated effect on the West African trade in palm oil and palm kernels which has made it imperative for all interested in the West African countries to consider various possible improvements in the industry so as to meet the threatened competition from the East.

According to the last *Bulletin of the Imperial Institute*, the present general trend of opinion is that the most promising way to increase the output of palm oil and kernels and to improve the quality of the former is by the installation of central factories. In such factories palm oil would be prepared under expert supervision by mechanical means, with the result that a greater yield of oil from the fruits would be obtained and the quality of the oil improved.

Serious consideration will have to be given to the question of the installation of central factories in Africa, as in this direction lies one of the chief ways of meeting the threatened competition. If such installation becomes general a large impetus will be given to the manufacture of this class of machinery, and will naturally lead to further improvements in design and in the processes. The future prospects of hand machines are not so promising as of those driven by power. The hand machines are especially designed for use by natives. Although it must be admitted that by their use the yield of palm oil and palm kernels is increased and the quality of the oil improved, yet it is doubtful whether for some years to come the natives will adopt these mechanical aids.

The use of nut cracking machines would enable the natives to prepare their supplies of kernels with less labour, but this does not appeal to them, as the supply of labour is ample for the purpose, the work being usually carried out by the women and children.—*Chamber of Commerce Journal.*

* * *

Formosa.

The area under rice cultivation was 619,159 acres, an increase of 21,040 acres, as compared with the same crop in the previous year. Production amounted to 14,055,586 bushels, a decrease of 1,697,267 bushels, or 11.2 per cent., as compared with the same crop in the previous year, but an increase of 9.8 per cent. over the average of crops for the preceding five years. Of the total production 5,852,416 bushels represented rice grown from Japanese seed (or "Horai Rice," as it is termed), and 8,203,172 bushels Formosan rice.

The yield per acre of 22.74 bushels showed a decrease of 11.6 per cent. as compared with the previous year, and 10.7 per cent. as compared with the average for the past five years. The total value of the crop is estimated at Yen 72,867,000. These results are regarded as most disappointing, and are due to the failure of the crop from Japanese seed, with which a very large area, about 250,000 acres, or nearly 40 per cent. of the total area under rice, was planted.

It seems evident that much further research will be necessary if this Japanese rice is to be successfully grown in a sub-tropical island like Formosa. During the past season the continuous rain experienced in April interfered with the growth of the crop and, in May, disease did much further damage. Owing to these causes the yield was greatly reduced, and the rice which was actually harvested was of very poor quality. A drop in rice prices in Japan accentuated the difficulties of producers and exporters, and a large proportion of the "Horai" rice crop remains in the hands of the dealers. This experience cannot but have the effect of discouraging farmers from planting the "Horai" rice in future years.—(*The Produce Markets Review.*)

* * *

Grenada.

In Grenada, nutmeg and its derivative mace now challenge cocoa for the premier position in the scale of exports; their combined export value in 1925 being £185,467 and that of cocoa, £197,231. Ten years ago cocoa accounted for 85 per cent. of the exports; nutmeg and mace for 10 per cent. During 1925 the principal crops were greater in volume and coupled with higher prices resulted in making the year one of the most prosperous in the history of Grenada. In this land of numerous small proprietors, the beneficial effects of this improvement were widespread and were reflected in the finances of the Government.

A new whaling industry established on modern lines on Glover's Island commenced operations in January, 1925. Seventy-two whales were caught and 112,963 gallons of whale oil, of the value £16,870 were exported.

The cultivation of cotton is confined to Carriacou and is the short staple variety called Marie Galante. The crop was a good one, amounting to 3,252 cwt. as compared with 2,842 cwt. in the preceding crop year. To an Ordinance for the eradication of the Pink Bollworm is ascribed the main reason for the increase.

All the cotton exported, 3,252 cwt. went to the United Kingdom.—(*Colonial Report No.* 1310.)

* * *

Ceylon.

The growing of grape fruit in Ceylon has now been tested and there is sufficient evidence to show that the Island can produce good crops of grape fruit in practically all districts and that its produce can with careful selection be made to rank with first class produce from other tropical countries. It therefore, only remains for Ceylon to establish an industry to meet its own requirements and those of its large continental neighbour and even to enter into the export trade in this fruit to the United Kingdom. The possibilities are there and it only remains for the industry to be taken up commercially. The total imports of grape fruit into the United Kingdom in 1924 alone amounted to 81,367 cwt. of a value of £140,686.—(*Tropical Agriculturist.*)

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Sulphur Dioxide in Sugar.

The first Schedule, Part 1 No. 8 of the Public Health (Preservatives, &c., in Food). Regulations 1925 made by the Minister of Health lays down that sugar may not contain more than 70 parts per million of Sulphur Dioxide. Clause 7 of the Regulations renders sellers contravening the Regulations liable to prosecution. Wholesale grocers in England, according to a recent communication from the W. I. Committee, are anxious to receive some assurance that West Indian Grocery Sugars do not, and will not contain, as much as 70 parts per million of Sulphur dioxide.

It may be here stated, for the information of those concerned, that a carefully manufactured Yellow Crystal with a fairly large grain can be safely assumed to comply with those Regulations. The presence and quantity of Sulphur dioxide can, however, be determined only by careful analysis.

* * *

South African Molasses in U.S.A.

A tank steamer discharged last October at Deepwater Point, N.J., U.S.A., a cargo of 1,500,000 gallons of blackstrap molasses from Durban, Natal.

Owing to the progress of the tank steamer fitted with Diesel engines as a carrier of liquid cargoes, it is now possible to sell and deliver blackstrap molasses from Java and South Africa in the United States at prices rivalling those of the Cuban product.

It is interesting to note that this steamer was to take back to South Africa a cargo of American Petrol (gasolene).

* * *

Displacement of Alcohol Fuel by Petrol.

Natal was one of the first communities to convert molasses into alcohol for use in internal combustion engines. The motor fuel "Natalite," which consists of a mixture of Alcohol and Sulphuric Ether (both produced from native molasses) has been largely used in South Africa for a number of years.

Alcohol fuel is apparently being displaced there by American petrol particularly since the installation in Natal of *bulk* plants to replace the sale of petrol in tins.

* * *

Celotex.

This building and insulating material, made from Megass, is in great demand at the present time in the U.S.A. It is manufactured at a plant located on the Mississippi River near New Orleans, La. Mr. T. B. Munroe, Vice-President of the Celotex Company describes the properties of Celotex as follows :—

Weight 0.6 lb. per sq. ft. of ½ inch thickness.
Tensile strength 375 lb. per sq. inch.
Water absorption (under water) 3 per cent. by volume in 4 hours.
Insulating value—Equal to cork, thickness for thickness.

Celotex may be painted, plastered, stuccoed or stripped and left in its natural colour. It is used in the place of wood sheathing on the exterior; for roof and wall insulation; as a base for inside plaster or exterior stucco; for portable houses, refrigerators and refrigerator cars; as an interior finish and for partitions; for sound deadening between floors, walls and apartments; for correction of acoustics; in auditoriums, graphophone rooms, &c.

* * *

Starch in Uba Products.

Starch has been found to be an appreciable impurity in Uba juices, syrups and even unrefined sugars in South Africa. Massecuites present difficulty in boiling, and give precipitates of dextrin with acid alcohol indicating the previous presence of starch. Vacuum pan coils become covered with a slimy black deposit. This appears to be a peculiarity of Uba cane, and is not met with in the better varieties.

The suggested remedies are as follows :

(1) Use cold maceration.
(2) Strain juices as much as possible.
(3) Add available manganese to soils to improve quality of juice (E. Haddon. —*The South African Sugar Journal*. 31st October, 1926.)

* * *

Safety Devices.

In *Sugar*, November, 1926, W. B. Tyler describes the safety measures in use at the Crockett Sugar Refinery, Cal., U.S.A.

Broken Centrifugal belts are rendered harmless by ¼ inch boiler-plate channel-type guards, designed by the officials of the plant to direct the belts against a brick wall in the rear where they stop automatically. Fly wheels, shaft couplings and air compressors are heavily guarded; and electrical fittings are properly insulated or screened. Many other safety devices have been thought out by the workers themselves, and the management appear to be doing all in their power to prevent accidents to their 1,500 employees.

* * *

Sugar Beet Yields.

The Sugar beet (Beta Vulgaris) yields about 10 tons per acre (in many cases 12 tons or more) with a sugar content ranging from 12 per cent. to 21 per cent. (average 15-17 per cent).

In 1840 one kilo of sugar was obtained from 17½ kilos of beet while in 1902 it only required 7 kilos of beet to yield a kilo of sugar. This improvement was not by any means all due to improved methods of manufacture. The Sucrose content of the Sugar beet had been gradually increased through careful selection of seeds, &c.

While originally the Sugar beet was inferior to the sugar-cane in Sucrose content, it is to-day considerably richer.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

THE ADVANCE OF ARTIFICIAL SILK.

[*The following article is based on an account by Mr. Otto Wilson, which appeared in "Industrial and Engineering Chemistry" for August* 1926.]

MANY long-established industries, founded for the utilization of natural products, are gradually yielding place to new industries which manufacture synthetic substitutes from quite different raw materials. The great world of business gyrates more and more round the chemical laboratory as centre. Among the latest achievements is the successful production of a new synthetic fibre, variously termed artificial silk, viscose silk or rayon. For thousands of years, cotton, wool, flax and silk have furnished the main supplies of clothing fabrics, but during the last forty years, the new fibre has reached a position ahead of silk, and may shortly rival even flax and wool.

History of the Artificial Silk Industry.

The founder of the artificial silk industry was the French Chemist, Count de Chardonnet, who introduced the first practicable process for spinning a cellulose thread in 1884, and exhibited fabrics made from it at the Paris Exposition in 1889. He lived long enough to see his invention produce one of the world's great industries.

For the first sixteen years following de Chardonnet's discovery, the history of artificial silk was mainly that of laboratory experimentation in search of improved methods of manufacture. At the beginning of the present century, three new processes were perfected and put into operation, and it is from this period that the commercial life of the synthetic textile really dates. Progress at first was slow. In 1914, the total world production of artificial silk was about 26 million pounds weight. During the last eight or nine years, however, production has increased very rapidly. In 1920 it had reached 50 million pounds; in 1923, 97 million pounds, and in 1925, about 185 million pounds. For the current year, the world's output is estimated at some 245 million pounds. This is well ahead of the estimated output of natural silk (86 million pounds), and is comparable with that of flax (1,000 million pounds), wool (2,900 million pounds) and cotton (13,000 million pounds). These figures are for raw fibre, but, when reduced to yarn weight or thread weight, the output of artificial silk is seen to be far ahead of natural silk, and much nearer flax and wool.

The United States of America is at present the world's leading producer and consumer of artificial silk, but it nevertheless has to draw on foreign sources to satisfy its demands.

Processes for producing Artificial Silk.

Four distinct processes of manufacture are nowadays practised in the artificial silk industry. All of them use cellulose as raw material, and yield a yarn of fine lustre as end product. The chemical and mechanical details differ in these four processes, as is indicated by the following notes.

Process 1.—(The original nitrocellulose process of de Chardonnet.) Cotton lint is nitrated to nitrocellulose, which is immediately dissolved in a mixture of ether and alcohol. The viscous solution is forced through fine glass tubes. The solvent evaporates from the resulting filaments on exposure to air. The filaments are twisted into threads, wound into skeins, and then denitrated.

Process 2.—(The cuprammonium process) Cotton lint or wood pulp is dissolved in a copper-ammonium salt solution and forced through small orifices. The resulting fibres are coagulated in a bath of sulphuric acid, twisted, wound on bobbins, and finally washed.

Process 3.—(The viscose process, by means of which some three-fourths of the world's production of artificial silk is manufactured.) Cotton lint or spruce-wood pulp is cooked with steam and pressed into sheets. These are soaked in a solution of caustic soda, then pressed, and shredded. After standing in air for several hours to oxidize, the alkali-cellulose is put into a slowly revolving churn, and sprayed with carbon disulphide. A brownish-yellow mass, called cellulose xanthate, results. This is dissolved in water, or dilute caustic soda solution, forming liquid viscose. After ageing, the liquid is forced through fine holes in a platinum plate into an acid coagulating bath. The fibres are finally twisted into threads.

Process 4.—(The cellulose acetate process.) The material produced by this process is markedly different from that resulting from either of the other processes and is usually not classed as artificial silk nor rayon. Cotton lint or wood pulp is treated first with acetic anhydride, then with water, and finally with an organic solvent. The cellulose acetate solution is forced through holes as before, and spun into "acetate" threads. As yarn, acetate silk possesses certain superior qualities to the three other forms, but it is more expensive to manufacture.

The essential mechanical devise for the successful manufacture of all artificial silk is the "spinneret," which consists of a pump that forces the cellulosic solution through a filter into a tube whose end is closed by a perforated plate. The perforations are some 0.002 to 0.005 inch in diameter, and are almost invisible to the naked eye.

Defects and Qualities of Artificial Silk.

The chief defect of the new artificial fibre is that it loses much of its strength when wetted. Garments made of it must therefore be very carefully laundered. Another defect is that artificial silk dyes rather unevenly. So far, these two defects have not been satisfactorily remedied, but improvements are expected.

The virtues of artificial silk lie chiefly in the facts that, unlike true silk, it may be bleached without turning yellow; it may be treated with either very hot or very cold water without detriment, and, above all, it possesses a striking lustre. It also takes certain dyes readily and permanently.

Uses of Artificial Silk.

The first use of artificial silk was for making braids and trimmings. Then artificial silk hosiery gained increasing favour, and recently knitted goods have been largely made from it. At present, artificial silk is increasingly employed for weaving with other fibres. A favourite method is to weave a bright artificial silk pattern into a cloth made of cotton, wool, or true silk.

Artificial Silk Factories in Various Countries.

The modern artificial silk factory requires a large capital expenditure for its initiation. In the United States, twelve companies out of the twenty-five registered, produced some 88 million dollars worth of artificial silk in 1925. Next to the United States, Italy is nowadays the largest producer of artificial silk, followed closely by Great Britain and Germany. Abundant water power and cheap labour have enabled Italy rapidly to develop its artificial silk industry, and in 1925, the largest Italian factory at Turin, produced 20 million pounds weight of the new fibre. In Great Britain, one large company, Messrs. Courtaulds Ltd., dominates the artificial silk industry. It has a capital of nearly 20 million pounds sterling, and produces more than nine-tenths of the British output. Together with its branches in other countries, the largest of which is the American Viscose Company, it now controls over one-half of the world's supply of artificial silk.

F. HARDY.

NOTE.—As regards the tropical agriculturist, the chief feature of interest arising out of the increasing demand for artificial silk, is the sources of supply of raw cellulosic material. At present, cotton lint and spruce-wood pulp are practically the only kinds of material employed. It is essential that the raw material be pure or "true" cellulose. Only a limited number of plants produce the right variety.

THE IMPERIAL INSTITUTE.

THE new galleries of the Imperial Institute in South Kensington, London, seek to keep alive that enthusiasm for Imperial matters which was awakened by the great Wembley Exhibition. The Institute has done much to develop the Empire's mineral resources. Its silk committee recently investigated the possibility of establishing a silk industry in Cyprus. As a result, a fully equipped silk factory was opened there on Empire Day this year, by the Governor, Sir Malcolm Stevenson.

EXPORTS of sugar from Mauritius during the crop year ending 31st July, 1926, amounted to 231,338 metric tons practically all of which went to Great Britain. Exports to India amounted to only 6,860 tons compared with 168,216 tons in 1924-25. The area planted in sugar-cane showed a decrease in 1926, being approximately 165,000 acres compared with 167,000 acres in 1925.

PHOSPHATE IN SUGAR-CANE JUICE.

The Rôle of Calcium Phosphate in Cane Juice Clarification.

IN the April, 1926, number of this Journal, an account was given of an investigation by Mr. R. G. W. Farnell, Chemist to the British Empire Sugar Research Association, into the chemistry of sulphitation in the cane sugar factory. We are now able to present the results of further work by this investigator on the chemistry of the precipitation of calcium phosphate in sugar-cane juice. The following account is based on a paper by Mr. Farnell that appeared in *The Journal of the Society of Chemical Industry*, 8th October, 1926, pp. 343 T to 347 T.

In the usual liming methods for clarifying sugar-cane juice, a precipitate of phosphate of calcium is formed by interaction between soluble phosphates normally present in the juice and added lime. This calcium phosphate is more or less insoluble in cane juice, and, if the prevailing conditions are suitable, it is precipitated in such a form that it adsorbs and carries down with it, varying quantities of impurities.

The natural phosphate content of cane juice varies considerably in different varieties of sugar cane, and is markedly influenced by soil composition, degree of maturity of the plant, and growth conditions. Records indicate that the range of variation lies between 0.006 and 0.087 grams of P_2O_5 per 100 cc. of juice. When the concentration is *less than* 0.030 gr. per 100 cc., difficulty in clarification and filtration of the limed juice is usually experienced, at least in Hawaiian factories where these relationships have been chiefly studied. When the concentration is *greater than* the critical value, the juice generally clarifies easily on liming.

There are several known phosphates of calcium, among which the acidic, mono-calcium phosphate and di-calcium phosphate are respectively very soluble and slightly soluble in water, whereas the more basic tri-calcium phosphate, and the highly basic complex compound, hydroxy-apatite ($Ca_3 (PO_4)_2$. $Ca (OH)_2$), are almost insoluble. When phosphoric acid is neutralized by successive small additions of lime (calcium hydroxide), a certain degree of alkalinity is therefore requisite to the precipitation of the phosphoric acid as insoluble calcium salt. The formation of various calcium phosphates apparently requires different, but adequate time periods. Thus the earlier attempts to elucidate the precipitation phenomena of calcium phosphates yielded different results, because the time factor was not always sufficiently considered. Another factor controlling the ultimate products of reaction between phosphoric acid and lime is temperature.

In his studies of calcium phosphate precipitation in relation to cane juice clarification, Farnell consequently attempted severally to control the factors (1) reaction time (2) temperature, (3) degree

of acidity or of alkalinity and (4) initial concentration of phosphoric acid. He followed, by chemical analysis, the course of combination and its visible result, precipitation, for phosphoric acid and lime in the presence of (*a*) water alone (*b*) water and sucrose and (*c*) water, sucrose and cane-juice colloids. The reaction time allowed throughout his experiments was one hour, because this is the customary time of settling observed in most cane-sugar factories. The temperatures employed were 30° and 98°C (cold liming and hot liming). The degree of acidity or of alkalinity was varied by successive additions of lime, and it was measured immediately after the additions, and again after one hour had elapsed, by the use of the quinhydrone electrode and of colorimetric indicators. All precipitates were removed by filtration, and the filtrates analysed for lime and phosphate by conventional quantitative methods.

The main results obtained are as follows :—

(*a*) *Neutralization in aqueous solution.*

Precipitation of crystalline dicalcium phosphate began just below pH 6.0. On further additions of lime, the pH value sank slightly, and then rose again slowly. Amorphous tricalcium phosphate began to separate here. Between pH 6.0 and pH 7.0 the precipitate consisted almost entirely of tricalcium phosphate; above pH 7.0, the more basic phosphate (hydroxyapatite) separated.

(*b*) *Neutralization in aqueous solution containing sucrose.*

Pure sucrose in 15 per cent. solution was found to have no effect whatever in delaying precipitation, nor in altering the amorphous nature of the tricalcium phosphate precipitate.

(*c*) *Neutralization in aqueous solution containing sucrose and cane-juice colloids, salts and acids.*

Normal cane juice is always acidic (pH about 5.0), because of the presence in it of certain organic acids. It also always contains ions of aluminium and iron, as well as phosphate ion. The first result of adding lime to cane juice is to precipitate these metallic ions as phosphates, because they are less soluble when the reaction of the medium is rendered slightly more alkaline than pH 5.0. At the same time, however, soluble calcium salts of the organic acids are produced, so that, if the juice does not normally contain much phosphate, but contains rather high amounts of organic acid, some delay is experienced in the precipitation of tricalcium phosphate, and a relatively high pH value must be realized before a definite precipitate of this compound begins to collect. Consequently, cane juice colloids under these conditions are not sharply removed. On the other hand, if cane-juice contains relatively large amounts of phosphate, or if phosphoric acid is deliberately added to it, a copious precipitate of tricalcium phosphate forms at a lower pH value on liming, and good defecation is secured. Farnell fixes the lower limit of initial concentration of phosphate for satisfactory removal of colloidal impurities at 0.005 to 0.01 gr. P_2O_5 per 100 cc. of juice. For values greater than, say, 0.03 gr. per 100 cc. (the Hawaiian critical value) practically all the phosphate will be precipitated, and good clarification usually obtained by liming to pH 7.0. Nevertheless, there must be some close relationship between the amount of colloidal matter present and the critical phosphate content requisite for good clarification. This relationship would appear to deserve further investigation.

F. HARDY.

THE SUCHAR PROCESS.

[*The following note has been received for publication. The claims advanced have been substantiated by independent enquiry and investigation.*—ED.]

FROM a statement that recently appeared in the *Financial Times* we learn that arrangements have been made for a further expansion in the exploitation of the Suchar Process of refining sugar, which has recently aroused so much interest in Louisiana, Porto Rico, South Africa, and elsewhere.

The rights of the Process for the United Kingdom, British West Indies, Egypt, China, Japan, Formosa, India, &c. have been secured by an English Company, "British Suchar Processes Limited," of 21, Old Broad Street, London, E.C.2, which was registered on the 4th October, 1926. This Company has very strong financial backing and is beginning its activities under the best possible auspices.

The results reported by refineries in which the Suchar Process is already installed are so promising that it would seem that it is at last possible to produce a standard refined sugar at the plantation. Moreover, the simplicity of the Process and the many economies effected are features which must arouse the interest of all sugar planters. According to reports received, the cost of refining by this Process is well below that of the Bone-char Process, while the quality of the sugar produced, if we may judge from shipments made from Porto Rico and Louisiana, is equal to the best on the market.

As far as the sugar planter is concerned, the most attractive features of the Suchar Process are the relatively small capital investment required, and the low water and fuel consumption. Moreover, the claim of the inventors that the carbon can be simply and completely reactivated after use, appears to be fully substantiated.

In addition to its use in the raw sugar factory, Suchar is finding an application in the Syrup, Jam, and Confectionary industries, as it enables the manufacturers to produce directly, from raw sugar, syrups which will conform to any specific requirements. It is gratifying to note the thoroughness with which the engineering details connected with the operation of the Process have been worked out, and it is obvious that those responsible have had wide personal experience in the sugar industry.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

The availability of Nitrogen in Green Manures.

The main results of field, greenhouse and laboratory experiments conducted by Dr. F. Lohnis of the United States Bureau of Plant Industry, and described in *Soil Science*, October, 1926, Vol. XXII, p. 253, should be of especial interest to our readers, since the advantages of green manuring are becoming widely acknowledged by tropical agriculturists. They may be summarized as follows :—

(1) The nitrogen availability of green manures was found to show wide variations, dependent on the quality and quantity of the material used, and on the nature of the treated soil. Small quantities of young green material gave better results than large quantities of old material, excepting for *cowpeas*, which were found to be of greater value when old.

(2) Between 50 and 80 per cent. of the nitrogen content of green manures becomes available for crop growth.

(3) Green manures accelerate the activities of soil micro-organisms and thus encourage more rapid nitrification of the humus nitrogen initially present in the soil. This remarkable effect may result in an apparent recovery of more than 200 per cent. of the nitrogen supplied by the green dressing for soils initially rich in humus.

* * *

A New Concentrated Fertilizer.

Among the new concentrated fertilizers that have already received attention in these Notes, may be mentioned ammonium phosphate, which supplies both nitrogen and phosphorus to soil dressed with it. Its chief quality lies in the fact that it contains little material that is not of direct fertilizer value, for 20 cwt. of the substance are equivalent in fertilizer value to 76 cwt. of a mixture of sulphate of ammonia and superphosphate of lime. Hence freightage is minimized when this concentrated fertilizer is imported into distant countries.

Ammonium phosphate is somewhat hygroscopic, and is very soluble in water. In order to render it easy to handle, it may be mixed with dry peat fibre. Such a mixture has been put on the market by the Stockton-on-Tees Chemical Works, Ltd., England. It contains about 20 per cent. of ammonia, 42 per cent. of phosphoric anhydride and 20 per cent. of organic matter and combined water. It is non-acid, easily available, dry and powdery, and is sold at current mixed-fertilizer unit prices. It can be mixed with potassic fertilizers, such as kainit, but lime, of course, must not be added to it, nor applied at the same time, since lime liberates ammonia gas from almost all ammonium salts.

Iodine in Rations.

It is now known that no animal possessing and needing a thyroid gland can do without iodine in its food. In the case of man, the presence of abundant iodine in the normal thyroid gland in the neck was proved 31 years ago, but it was not until 1917 that certain American doctors began to enquire whether the use of small quantities of iodine as a food might affect the incidence of goitre. By the use of iodized common salt, goitre in Ohio, and later in Switzerland, was reduced.

The sea is the natural reservoir of iodine, and it is generally assumed, therefore, that districts situated near the sea are goitre-free. This generalization, however, does not hold, unless the prevailing winds, carrying sea-spray, blow from the sea, and unless lime is scarce, for there is a certain "lime-iodine ratio" requisite for proper nourishment, and where lime is abundant, more iodine than otherwise is needed. In Cornwall and in New Zealand, both maritime regions, goitre is quite common for either or both of these reasons. In some Swiss Cantons, and in some of the states of the American Union, nothing but iodized salt is now-a-days allowed to be sold. In other districts the municipal water-supply is artificially iodized for reasons of public health.

Iodine has achieved significant results in the feeding of pigs and other thyroid-possessing animals, and its importance in rations is now well established.

* * *

Soya Bean Products.

Soya bean cultivation has increased enormously in recent years. It is estimated that the acreage devoted to its cultivation is increasing at the rate of 15 per cent. per annum. The largest output is from Manchuria, which produced some four million tons of beans in 1925-26, from five million acres of land, and which possesses more than 500 mills for producing soya bean meal and oil.

Soya bean forms the staple food of many people in Asia. It yields a valuable oil, a flour, a sort of cheese, vermicelli, and cattle cake. The flour has high nutritive value ; it contains some 57 per cent. of protein, 17 per cent. of carbohydrate, and 3 per cent. of fat. The oil is chiefly used for manufacturing soft soaps, margarine and lard substitute. It is a drying oil, and, when the price of linseed oil rises, it is largely used for making paints. Much soya bean oil is shipped to South America, whence it reappears as "olive oil."—*Industrial Chemist*, September, 1926.

* * *

A Mould Preventative for Rubber.

Latex, coagulated by acetic acid containing paranitrophenol, gives crêpe and smoked sheet that are mould-free, of good appearance, and of normal vulcanization behaviour.—H. P. Stevens, *Bull. Rubber Growers' Assoc.* 1926, p. 177.

THE COLLEGE.

AT a luncheon to Dominion Premiers, given by the Governing Body of the Imperial College of Tropical Agriculture on 12th November, 1926, at the Carlton Hotel, promises of sympathetic consideration for the claims of the College were given by the Dominion representatives attending. Sir Arthur Shipley, who presided, said that although the College Building for reasons of accessibility was situated at Trinidad, its students were sent out to the whole of the British Empire, and especially to those parts which lay within the tropics. Although a large portion of the King's Dominions beyond the seas was tropical, there was a great dearth of agriculturists who had had a thorough training in tropical agriculture. Men trained as advisers, administrators, and estate managers were wanted everywhere, and it was that need that the Trinidad College was hoping to satisfy. There was a really appalling dearth of entomologists and mycologists for the whole Empire and that state of affairs the College was endeavouring to redress. The two great problems that lay before them were how to provide adequately a sufficient supply of men of science, and how to develop agricultural products of every kind. It was their confident hope that the Dominions would take their part in securing the development of that great Imperial movement, and he sincerely hoped that representatives of the Dominions would be nominated to sit on the Governing Body.

The Rt. Hon. L. S. Amery, Secretary for Dominion Affairs spoke of the financial position of the College and said that the Empire Marketing Board was proposing to take into consideration an annual grant towards carrying on the ordinary work of the College, but that did not diminish the need for a substantial endowment fund to put the institution beyond all financial risks. At the same time it was of interest to know that its stability and permanence had been recognised by the fact that it had now been granted a Royal Charter of incorporation.

The Right Hon. S. M. Bruce, Premier of Australia, said the Dominion he represented took the greatest possible interest in the work that was being carried out, and if there were anything they could do to help they would be only too pleased to do it, because they believed that it was a great and useful work.

The Right Hon. J. G. Coates, Premier of New Zealand, also expressed his keen interest in the movement, and said his government would consider the question very seriously as to how best it could give assistance.

Sympathetic references to the work of the college were also made by the Hon. Vincent Massey (Canada), the Hon. N. C. Havenga (Minister of Finance, South Africa), the Hon. W. J. Higgins (Minister of Justice, Newfoundland), and the, Maharajah Bahadar of Burdwan. The latter mentioned that the first college of tropical agriculture was established in India under the Vice-royalty of the Marquis Curzon, at Pusa.

The following were present :—

Prime Ministers and Dominions Representatives.

The Right Hon. S. M. Bruce, P.C., M.C., Prime Minister ..Australia.
The Right Hon. J. G. Coates, P.C., M.C., Prime Minister ..New Zealand.
The Hon. Vincent Massey ..Canada.
The Hon. N. C. Havenga, Minister of Finance ..South Africa.
The Hon. W. J. Higgins, K.C., Minister of Justice ..Newfoundland.
Sir Francis Bell, G.C.M.G., K.C., Min. without Portfolio ..New Zealand.
The Maharajadhiraja Bahadur of Burdwan ..India.
Mr. D. T. Chadwick, C.S.I., C.I.E., Secretary to Government of ..India.
The Right Hon. L. S. Amery, M.P.
The Right Hon. The Lord Queensborough, G.B.E.
The Right Hon. The Viscount Burnham, C.H.
The Right Hon. Sir Halford Mackinder, P.C.
Sir Campbell Stuart, K.B.E.
Mr. S. G. Tallents, C.B., C.B.E.
Mr. R. H. Jackson.
Mr. Charles F. Wood.
Mr. Harold Cox.

Governors of the College.

Sir Arthur Shipley, G.B.E., LL.D., SC.D., F.R.S.
Lt.-Col. Sir David Prain, C.M.G., C.I.E., F.R.S.
Professor F. O. Bower, SC.D., LL.D., F.R.S.
Sir James Currie, K.B.E., C.M.G.
Mr. E. R. Darnely, M.A., B.SC.
Sir Edward Davson.
Mr. E. A. de Pass.
The Master of Elibank.
Sir John Farmer, M.A., D.SC., LL.D., F.R.S.
Mr. W. Scott Herriot, Assoc.M.Inst.C.E., M.I.Mech.E.
Captain Arthur W. Hill, C.M.G., M.A., SC.D., F.R.S., F.L.S.
Sir William Himbury.
Sir Norman Lamont, Bt., J.P., D.L.
Sir Robert Rutherford.
Mr. G. Moody Stuart and
Mr. Algernon Aspinall, C.M.G., C.B.E.

CITRICULTURE.

A SPECIAL course in citriculture will be given in 1927 in the Department of Horticulture of Transvaal University College, Pretoria. Lectures will cover all phases of orange growing, such as nursery practice, bud selection, irrigation, fertilisation, insect and disease control, picking, packing and marketing.

POST WANTED

In the West Indies as planter or engineer, applicant aged 40, single, 15 years' engineering experience ashore and afloat (chief engineer's certificate) one year farming, war service. Communications to be sent to George Aitken, Craigmarloch, Yoker, Dumbartonshire, Scotland.

REVIEWS.

THE HANDBOOK OF THE BRITISH WEST INDIES, BRITISH GUIANA AND BRITISH HONDURAS, 1926-27, by Algernon Aspinall, C.M.G., C.B.E., London, The West India Committee, 1926.

Mr. Aspinall, whose keen interest in the West Indies is well known, has produced a very useful book of some 200 pages in which the Colonies in the Caribbean are briefly described, and a short historical account given of each with reference to their principal product. The form of Government is described for each Colony and Presidency and it is shown that a very large measure of popular representation is enjoyed in them all, even where the Crown Colony form of Government prevails.

The subject of West Indian Federation is dealt with principally from the historical point of view and the various combinations that have been made between islands by federation of one sort or another are indicated. Some of these are still in force while many have been tried and given up.

The chapter on Canada and the West Indies briefly reviews the earlier attempts to bring about closer trade relations between these Colonies and Canada. The Dominion Tariff Act of 1897 provided for a preference of 25 per cent. to raw sugar and certain other products imported into the Dominion from the British West Indies, British Guiana, and British Honduras. In 1909, a Royal Commission, made inquiry into the subject and in 1912 a Conference held at Ottawa was followed by a reciprocal trade agreement for a period of ten years, and a more comprehensive agreement was signed in 1920. In 1925, as a result of a third Conference, a new agreement was signed which is presented in full. This agreement not only provides for an adjustment of preferential tariffs reciprocal between the parties to the Conference, but it also makes provision for an improved steamship service with facilities for carrying fresh fruits under suitable conditions.

Mr. Aspinall gives a list of West Indian Conferences, of which there have been some twenty-two, commencing with the first Agricultural Conference in 1909 at Barbados and including that held in London in May of the present year. It should be noted that nine of the West Indian Conferences were Agricultural Conferences and it should be stated that they were organised by the Imperial Department of Agriculture. Indeed one wonders why no mention of the Imperial Department of Agriculture should occur in a book such as this and why no reference should be made to its work. It is true that this Department does not now exist as a separate organisation, as it has been amalgamated with the Imperial College of Tropical Agriculture, and its Commissioner is the Principal of the College, but it is to be hoped that the useful work which the Department carried on for so many years will be continued. The Imperial Department of Agriculture has played a very important part in agricultural development in the West Indies since its establishment in 1898, and the work of Sir Daniel Morris and Sir Francis Watts as Imperial Commissioners, and of the men who worked with them and under their direction, has certainly contributed its full share to any degree of prosperity that these West Indian Islands have enjoyed during that time.

H. A. B.

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COTTON AND ITS PRODUCTION.—W. H. Johnson. 30s. net. Macmillan & Co., Ltd., London.

This is a volume of 536 closely written pages including an introduction by Sir Wyndham Dunstan and a foreword by Sir William Himbury. It is a compilation that must have caused the author an immense amount of labour. As a work of reference it possesses a definite value as it gives on the whole a fair idea of the state of the cotton growing industry in the various Colonies and Dependencies of the British Crown at the time it was written. One cannot help thinking, however, that much of the information will be out of date in a few years time and will then prove to be of historical interest only. The fact is that the efforts now being made in the various overseas dependencies are, at the present moment, being confronted with a severe crisis in the shape of unexpectedly low prices for the raw product. Certain areas which started a cotton growing boom with cotton selling at fifteen pence are naturally exhibiting a reaction now that the price has fallen to half that amount. Some will weather the storm, others will probably succumb. Undoubtedly the recent history and future prospects of some of these areas will need revision in view of existing conditions and the recent fall in prices.

The book contains much valuable information and should prove a useful reference book to students. The information it contains is easier to get at than in that standard work of reference by Sir George Watt "*The Wild and Cultivated Cotton Plants of the World*," and it has the further advantage of being in many respects more up to date.

G. E.

* * *

TROPICAL GARDENING AND PLANTING.—By H. F. Macmillan, F.L.S. The Times of Ceylon Co. Ltd., Colombo 1925. Price £1 17*s.* 6*d.* or Rs. 25.00.

This is a third and revised edition of a work which has already earned for itself a wide reputation. For those who do not know it, the book may be described as an encyclopaedia of tropical horticulture, and though written with special reference to Ceylon it is by no means of merely local interest.

The planter is unlikely to derive much benefit from its scanty paragraphs on major crops, but the garden enthusiast, for whom it is primarily intended, will find herein a mine of information on every aspect of his hobby.

Some four hundred illustrations from photographs of ornamental and useful plants are an important feature of the book.

E. E. C.

BIOLOGICAL RESEARCH.

[We reproduce the following letter from "Nature" with the object of calling attention to the facilities which the College is in a position to afford to scientists of recognised standing who wish to pursue their research work under tropical conditions. Facilities similar to those afforded to Dr. Dunkerly are available to specialists in all the other branches of science represented on the College Staff.]

During the months July to September this year I was enabled to do some research work on protozoan parasites at the Imperial College of Tropical Agriculture in Trinidad, B.W.I. thanks to the generosity of the Governing Body in granting me free facilities there.

As I feel that the possibilities of the College as a centre for tropical research are not sufficiently known to biological workers at home, I venture to direct attention to the fact that for research workers in almost any branch of tropical biology, there is no more convenient place for headquarters than the College. Though, of course, its teaching activities deal more exclusively with agriculture, the Governing Body and the Principal, Dr. Leake, were most generous in allowing me facilities for prosecuting my research, which was not connected directly with agriculture.

At the present time the only tropical research laboratory easily accessible to British workers is the one at Kartabo, British Guiana, run by Mr. Beebec under the auspices of the New York Zoological Society. Trinidad has the advantage of involving a shorter journey, and the biological worker will find large laboratories, which will soon be very well equipped, thanks to the new government grant. But, of course, the main point of importance to the biologist in the tropics would be the abundance of tropical forms, and here Trinidad compares favourably with other West Indian Islands, as it is the most tropical of them all, and the flora and fauna are more South American than West Indian in affinities. There are large tracts of primitive forests which are under government control and form wonderful collecting grounds.

To a worker who can spend only a short time in the tropics, the presence of an expert staff such as that at the Imperial College of Tropical Agriculture can be invaluable, especially when backed by the valuable entomological, &c., collections which the College possesses. The College works in happy unison also with the Department of Agriculture, where again one found the most able and ready assistance on the part of the local experts, including my friend Mr. Urich, who possesses an unrivalled knowledge of the island fauna.

On these grounds, and on others which are too numerous to enumerate here, I wish strongly to urge that biologists who desire to do tropical research could not do better than obtain permission to work at this College, permission which, I have no doubt, will be granted in all suitable cases.—The University, Manchester.—*Nature*, 6th November, 1926.

J. S. DUNKERLY.

COLLEGE NEWS.

Among the visitors to the College recently have been: The Hon. A. E. Collins, Antigua, a Governor of the College; Mr. C. A. Archibald, Nova Scotia; Mr. N. Munro Kerr, Scotland, and Sir Alexander and Lady Prince, London.

SPORTS.

The following are the results of the matches played by the Students of the College to date, the scorers for the College being noted in brackets.

Association Football Club.

29th Nov...Imperial College ..1 (Follett-Smith)
Trinidad Constabulary (away).

5th Dec...Imperial College ..5 (Follett-Smith 2, Newam 2 Martin 1).
Leaseholds United 0 (away).

Rugby Football Club.

21st Nov...Southern Rugby Club and Imperial College combined ..0
Trinidad Rugby Club 8 pts. (away).

11th Dec...Southern Rugby Club and Imperial College combined ..3 pts. (Gillespie)
Trinidad Rugby Club 9 pts. (away).

Hockey Club.

27th Nov...Imperial College ..0
Trinidad Constabulary 3 (away)

7th Dec...Imperial College ..6 (Rutter 4 Potter 2)
Trinidad Constabulary 2 (away).

BOOKS RECEIVED.

We have to acknowledge the receipt of the following books:—

Insects; Their Structure and Life. By G. H. Carpenter, D.SC., pp. 385, with 4 coloured plates and 184 black and white Figures. G. M. Dent & Sons, 10*s.* 6*d.*

Dictionary of Botanical Equivalents. By Ernst Artschwager, PH.D. and Edwina M. Smiley, M.A., pp. 124. Bailliere, Tindall and Cox. 14*s.* 6*d.* net.

The Essential Oils, Their Chemistry and Technology. Horace Finnemore, B.SC., Lond., F.I.C., pp. 138. Ernst Benn, Ltd. 70*s.*

Naturalist's Guide to the Americas. Assembled and edited by the Chairman, Victor E. Sheffield, pp. 761. 16 Figures. Bailliere, Tindall and Cox, 45*s.*

The Handbook of South America. A Guide to the Countries and Resources of Latin-America, inclusive of South and Central America, Mexico and Cuba, pp. 706 and map, South American Publications, Ltd.

A Trichromatic Colorimeter suitable for Standardisation. By J. Guild, A.R.C.S., &c. Reprint from the *Transactions of the Optical Society*, Vol. XXVII, No. 2, pp. 129.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Some excitement has been caused in consequence of the announcement that the President of Cuba had agreed to restrict the coming Cuban crop to 4,500,000 tons. The Decree, it is understood will also prohibit the cutting of cane before 1st January, 1927, which will delay the arrival of new crop Cubans on the market and decrease the likelihood of any substantial carry over of old crop sugars. It is also suggested that a World Conference will be held in Havana at the end of the season to study international sugar problems with a view, presumably, of exploring the possibility of adopting measures to ensure some stabilisation of prices. The total decrease in the world output of sugar is now estimated to exceed 1,000,000 tons. The market has quickly responded to these factors. Cubans 96° *c.i.f.* were quoted at 15*s.* 9*d.* per cwt. on 25th November. A cabled report of 15th December quotes foreign sugar 96° *c.i.f.* at 16*s.* 3*d.* and preferential at 19*s.* 9*d.*, each per cwt. A cable of the same date from New York quotes Cubans 96° *c.i.f.* at $3.32 per 100 lb. Futures still show advances over spot quotations, September, 1927 being now quoted at $3.50. All prices, it will be seen, show appreciable advances since our last report, and the market is animated and firm.

COTTON.—The latest Bureau report shows another substantial increase in expected crop but interest is at present concentrated more upon the method in which the crop will be sold and its quality. Mid-American was quoted at 7.03*d.* on 19th November. There are indications that the American crop is being placed judiciously upon the market. It is stated that a cotton fund has been organised and is available to assist in marketing, but it is unlikely that it will be utilised since its mere existence will tend to restore confidence. Cables of 15th December quote Sea Island good at 2*s.* 4*d.* per lb.

CACAO.—The market for Accras has developed strength during the past month. On 17th November, 59*s.* to 60*s.* per cwt. was paid for good fermented Accras spot. Plantation Trinidad was quoted at 68*s.* to 70*s.* and ordinary to fine Grenada at 60*s.* to 65*s.* Other descriptions were neglected. A cabled report of 15th December, quotes Trinidad L.L.T. at 70*s.* to 73*s.* per cwt. while in New York the quotation for Trinidad is 15¼*c.* per lb. London stocks according to our latest information amount to 73,151 bags compared with 103,009 bags in 1925, while in Liverpool stocks amount to 7,781 against 74,722 bags in 1925. The statistical position is therefore strong.

COFFEE.—Only moderate quantities have been brought forward during the month of which a considerable proportion has consisted of East Africans. The tone of the market for good to fine quality African coffee has been decidedly strong and nearly all was disposed of at advances varying between 2*s.* and 4*s.* per cwt. No interest has been shown in ordinary and unwashed grades. The Brazilian market continues to be dominated by fluctuations in the exchange. On the whole quotations are firmer, Superior Santos, *c.i.f.* being quoted at 93*s.* to 94*s.* and No. 7 Rio at 76*s.* per cwt. on 17th November. A Santos crop of 15,000,000 bags is expected for next year. Trade in ordinary Jamaica is nominal. Some Blue Mountain sold for 210*s.* 6*d.* for the bold size and 195*s.* for Peaberry.

TEA.—The decline in prices has continued but has not been unexpected. Sales have been very good and have only recently commenced to flag. Imports have been well maintained and more than usual has been taken out of bond but there has been a 6 per cent. decline in exports. The relative use of better grades has increased. Prices on 17th November included Ceylon 19.31*d.*, Indian 17.43*d.*, and Java 13.48*d.*

RUBBER.—The market has been fairly active and prices have shown some fluctuation. Spot sheet sold at 1*s.* 7¼*d.* on 25th November and Crêpe at 1*s.* 7⅛*d.* each per lb. Stocks in London on 20th November amounted to 44,553 tons showing a slight increase.

COPRA.—Some slight improvement in the market is reported but the general tone remains dull. Quotations on 17th November included £29 5*s.* for F.A.Q. Ceylon to London, £27 15*s.* for Sun-dried Straits to Rotterdam, and £26 15*s.* for Straits to Marseilles. West Indian descriptions are quoted at £27 10*s.* to £27 15*s.*

GROUND-NUTS.—East African arachis is of high quality and makes £21 10*s.* per ton. Chinese were quoted at £19 7*s.* 6*d.* on 17th November.

PALM AND PALM KERNEL OILS.—Palm Oil has experienced a decline of 10*s.* per ton to £36 10*s.* Palm Kernel Oil is quoted at £41.

GINGER.—At the lower levels now established the demand has been stronger. Common to middling Jamaica is quoted at 57*s.* 6*d.* to 70*s.*, good to fine at 75*s.* to 85*s.* per cwt. West African is quoted at 36*s.* spot. London stock of Jamaican amounts to 8,008 packages against 6,900 last year.

NUTMEGS AND MACE.—The nutmeg market shows no improvement and some sound unassorted parcels have sold at cheap rates. Mace continues to be firm owing to the small supplies available.

CONTRIBUTIONS.

THE EDITOR is prepared to consider signed articles for publication in *Tropical Agriculture*. Such articles should normally vary between 1,000 to 6,000 words and may be illustrated if desired. Rates can be obtained on application to the Editor.